AIREDALE

air conditioning for every environment

# INSTALLATION, OPERATING & MAINTENANCE MANUAL

## Ultima 2000

### Air Cooled Screw Liquid Chiller

### 250 - 650 kW

BSI REGISTERED LRQA 003

BS EN ISO 9001 BSI REGISTERED Cert. No FM00542 Registered November 1985

INVESTOR IN PEOPLE

# About Airedale Products & Customer Services

**EUROVENT**

Airedale participates in Eurovent Certification as a founder member. The Eurovent Certification programme verifies product performance by managing random independent testing of certified products.

We participate in certification programmes for Air Conditioners, Chillers and Fan Coil units, which enable consultants, specifiers and End Users to compare and select products with assurance that the catalogue data is accurate.

All new products are tested by Eurovent before being Certified. For certified products only the Eurovent symbol appears alongside the certified product performance data.

**THE ENVIRONMENT - R407C – THE NATURAL REPLACEMENT FOR R22**

Protecting the environment is a priority and we take care to ensure our products are developed and manufactured with this in mind. Airedale introduced R407C refrigerant in 1992 and now has the most extensive in-field experience in the air conditioning industry. R407C is offered on all Airedale products and all new products are developed to provide optimum efficiency with this refrigerant ensuring maximum customer choice.

**WARRANTY, COMMISSIONING & MAINTENANCE**

The equipment carries the Airedale ***unit parts and labour warranty*** in respect of non-consumable parts, for a period of ***12 months*** from the date of despatch. Commissioning will be carried out by Airedale International Air Conditioning Ltd or an approved Airedale commissioning company.

To further protect your investment in Airedale products, we have introduced Airedale Service, who can provide full commissioning services, comprehensive maintenance packages and service cover 24 hours a day, 365 days a year (UK mainland). For a free quotation contact Airedale Service or your local Sales Engineer.

**CAUTION** **Warranty cover is not a substitute for Maintenance. Warranty cover is conditional to maintenance being carried out in accordance with the recommendations provided during the warranty period. Failure to have the maintenance procedures carried out will invalidate the warranty and any liabilities by Airedale International Air Conditioning Ltd.**

**SPARES**

A spares list for 1, 3 and 5 years will be supplied with every unit and is also available from our Spares department on request.

**TRAINING**

As well as our comprehensive range of products, Airedale offers a modular range of Refrigeration and Air Conditioning Training courses, for further information please contact our Training Co-ordinator.

**CUSTOMER SERVICES**

For further assistance, please e-mail: **marketing@airedale.co.uk** or telephone:

**UK Sales Enquiries .....Tel: + 44 (0) 113 238 7789 & 7799**
**International Enquiries.....Tel: + 44 (0) 113 239 1000**
**Spares Enquiries .....Tel: + 44 (0) 113 238 7723 & 7727**
**Airedale Service.....Tel: + 44 (0) 113 238 7704, 7746 & 7748**
**Training Enquiries.....Tel: + 44 (0) 113 238 7738**

For information, visit us at our Web Site: **www.airedale.co.uk**

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# General Statement

**IMPORTANT**

The information contained in this manual is critical to the correct operation and maintenance of the unit and should be read by all persons responsible for the installation, commissioning and maintenance of this Airedale unit.

**SAFETY**

The equipment has been designed and manufactured to meet international safety standards but, like any mechanical/electrical equipment, care must be taken if you are to obtain the best results.

**CAUTION** **1** **Service and maintenance of Airedale equipment should only be carried out by Technically trained competent personnel.**

**CAUTION** **2** **When working with any air conditioning units ensure that the electrical isolator is switched off prior to servicing or repair work and that there is no power to any part of the equipment.**

3 Also ensure that there are no other power feeds to the unit such as fire alarm circuits, BMS circuits etc

4 Electrical installation commissioning and maintenance work on this equipment should be undertaken by competent and trained personnel in accordance with local relevant standards and codes of practice.

5 Refrigerant used in this range of products is classified under the COSHH regulations as an irritant, with set Occupational Exposure Levels (OEL) for consideration if this plant is installed in confined or poorly ventilated areas.

6 A full hazard data sheet in accordance with COSHH regulations is available should this be required.

**EMC STATEMENT**

In accordance with CE marking requirements, all Airedale products are tested for EMC emissions and susceptibility to European Standards EN 50081-1 and EN 50082-1 respectively.

To ensure trouble-free operation of all electronic equipment, the operating environment must comply with the same EN standards. Failure to ensure the environment meets this standard could affect the operation of the equipment.

# Warranty

Please refer to the ***Order Acknowledgement*** for details of the warranty package.

**Inclusions**

Warranty will cover parts and labour for a period of 12 months.

Warranty cover will commence from the date of invoice unless an alternative date is requested in writing.

Airedale will accept warranty commencing dates from completion of commissioning or on date of contract completion up to a maximum of 6 months from date of delivery, subject to the equipment being properly protected and serviced in the period between delivery and hand over.

Airedale will provide labour costs for replacement of part failed under warranty conditions subject to the following:

- The on site contractor or service company place an official order on Airedale for the replacement part including site labour if required. Airedale will acknowledge this order with detailed prices for components, travel and labour rates.
- When warranty is accepted, following inspection of the faulty component, a credit note will be issued against an invoice raised in line with the acknowledgement.
- Should warranty be refused the invoice raised against the acknowledgement becomes payable on normal terms.
- Airedale reserve the right to carry out site warranty labour work using their own direct labour or by sub contracting to an approved company of their choice.

**Exclusions**

Warranty may be refused for the following reasons:

- Misapplication of product or component.
- Incorrect site installation.
- Incomplete commissioning documentation.
- Inadequate site installation.
- Inadequate site maintenance.
- Damage caused by mishandling.

**General**

Dead on arrival or manufacturing defects are the responsibility of Airedale and should be reported immediately.

In the event of a warranty failure, dead on arrival or manufacturing defect, the Airedale Service department should be contacted and on receipt of an order, an Airedale engineer (or representative) will be directed to site as soon as possible.

# General Description

**UNIT IDENTIFICATION**

| AIR COOLED SCREW LIQUID CHILLER | |
|---|---|
| **USC** | **Ultima Screw Chiller** |
| **250 - 650** | Model Size (Expressed as Nominal Cooling in kW) |
| **D-** | **D**ual Circuit - Standard Chiller |
| **DQ-** | **D**ual Circuit - **Q**uiet Chiller |
| **DSQ-** | **D**ual Circuit - **S**uper **Q**uiet Chiller |
| **8, 12 or 16** | Number of Fans |
| **Example** | **USC300D-8** |

**INTRODUCTION**

The Airedale range of Ultima air cooled liquid chillers covers the nominal capacity range 250kW to 650kW in 27 model sizes including Standard D, Quiet DQ and Super Quiet DSQ variations.

Attention has been placed on maximising the unit's performance while keeping the sound levels and footprint to an absolute minimum.

**REFRIGERANTS**

The range has been designed and optimised for operation with the ozone benign R407C refrigerant.

**STANDARD CHILLER - D**

The Standard Ultima chiller comes complete with:

- Head Pressure Control - fans are individually switched by a Microprocessor
- Evaporator Trace Heating
- Quiet Fans
- Single Screw Compressors
- Shell & Tube Evaporator
- Dual Independent Refrigeration Circuits

**QUIET CHILLER - DQ**

With the benefits of the Standard range, the Quiet chiller is supplied with an acoustic package, which incorporates:

- Acoustically lined compressor enclosures
- 3 phase Head Pressure Controllers, which modulate the fan speeds collectively to maintain a constant condensing pressure with minimum fan speeds.

**SUPER QUIET CHILLER - DSQ**

With the benefits of the Standard range, the Super Quiet chiller is supplied with a Quiet acoustic package, which incorporates the following to become one of the quietest chillers available:

- Acoustically lined compressor enclosures
- Reduced speed 680 rpm condenser fans
- 3 phase Head Pressure Controllers, which modulate the fan speeds collectively to maintain a constant condensing pressure with minimum fan speeds.
- The use of enhanced performance condenser coils on the DSQ Quiet Package enables a chiller capacity similar to the D and DQ models to be maintained.

# General Description

**REFRIGERATION**

Each refrigeration circuit is supplied with the following:

- Full operating charge of R407C
- Liquid injection oil cooling circuit fitted to each compressor as standard with sight glass, strainer and non-return valve
- Thermostatic expansion valve with external equaliser
- Liquid line ball valve
- Discharge line ball valve
- Liquid line solenoid valve
- Large capacity filter drier with replaceable cores
- Liquid line sight glass
- Low pressure switch with manual reset
- High pressure switch with manual reset
- Suction and liquid pressure transducers
- Pressure relief valve with integral rupture disc and indicator gauge

**CONTROLS**

Microprocessor controller to provide between 6 to 8 stages of capacity control (dependant upon model size) as standard. The controller incorporates full Building Management System capabilities, full details can be found in the ***Controls*** section.

**ELECTRICAL**

A weatherproof electrical power and controls panel is situated at the end of the unit and contains:

- Individual mains power compartments for each refrigeration circuit
- Separate door locking electrical isolation for each mains compartment
- Emergency Stop fitted to controls compartment door
- Separate, fully accessible, controls compartment, allowing adjustment of control set points whilst the unit is operational
- Dedicated bus-bar chamber for connection of incoming 3 phase and earth mains power supply
- Circuit breakers for protection of all major unit components
- Phase Rotation Relay also incorporating loss of phase protection
- The electrical power and control panel is wired to the latest European standards and codes of practice

**OPTIONAL EXTRAS - ENERGY SAVING**

**Power Factor Correction**

When applied to the motors of each compressor, the compressor power factor is controlled to a minimum operating value of 0.95 at the full operating capacity. This satisfies many supply authorities that may impose surcharges on equipment with power factor less than 0.95.

**Electronic Expansion Valves**

Electronic expansion valves differ to the normal thermostatic expansion valves in their ability to maintain control of the suction superheat at reduced head pressures. This can lead to significant energy savings particularly at minimum loading and low ambient temperatures.

**Modulating Head Pressure Control (-20°C)**

**Model D Only**

A 3 phase head pressure controller which modulates the fan speed to maintain a constant condensing pressure can be fitted on request.

# General Description

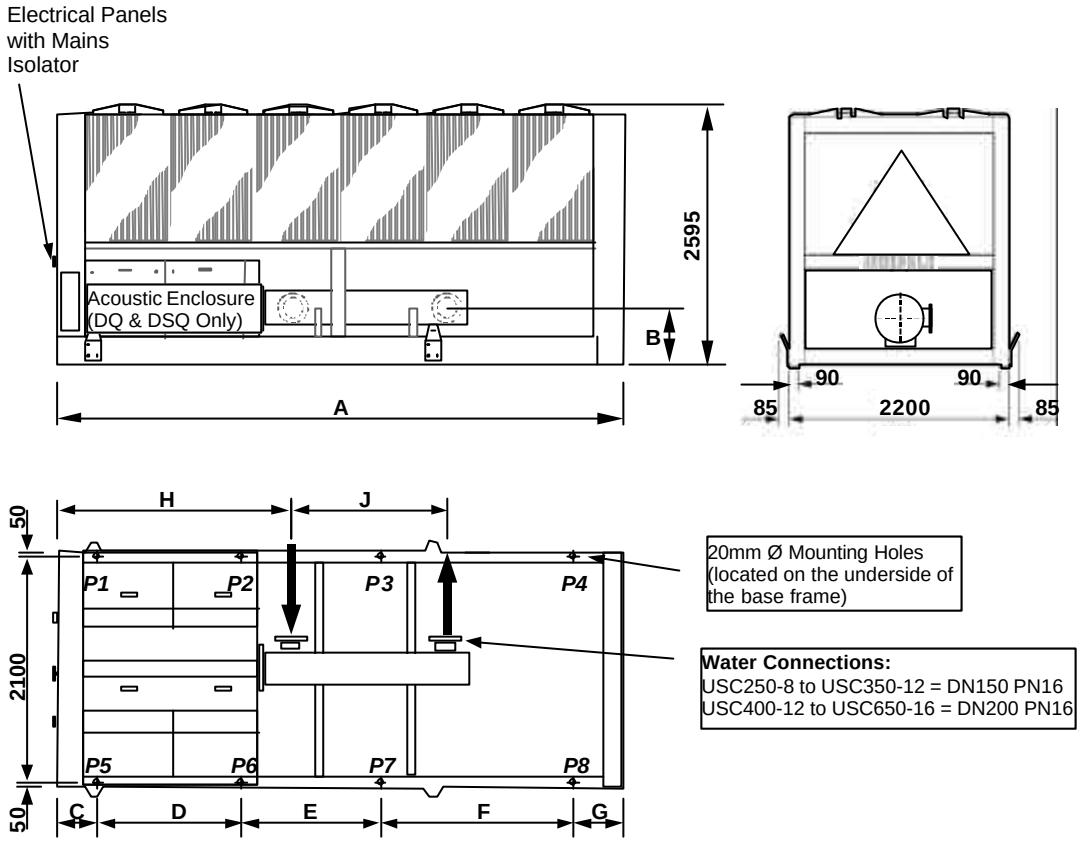
**OPTIONAL EXTRAS - GENERAL**

| | | |
|---|---|---|
| **Loose Item** | • Anti Vibration Mounts<br>• Flow Switch<br>• Condenser Fan Discharge Air Plenum | Instructions supplied with item |
| | • Sequence Controller | Refer to ***Sequence Controller Manual*** provided with this option |
| **Factory Fitted** | • Epoxy Coated Condenser Coils | |
| | • Coil Guards | |
| | • Dual Pressure Relief Valve | |
| | • Electronic Expansion Valve | |
| | • Modem Link | Refer to ***Airedale*** for further details |
| | • Closed Transition Star/Delta Compressor Start | Refer to ***Commissioning*** Section for details |
| **Optional Unit Cover** | • Commissioning<br>• Chillerguard® Health Check<br>• Chillerguard® Maintenance | For details and a competitive quotation, contact ***Airedale Service***. |

# Installation Data

**DIMENSIONS & WEIGHTS**

***Note: Water connections shown are standard, other handing options are available upon request.***




**Dimensions**

| | | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|---|
| **USC250DSQ-8 to USC300DSQ-8** | mm | 4040 | 460 | 435 | 1120 | (1) | (1) | 655 | 1837 | 1753 |
| **USC350DSQ-12** | mm | 5740 | 460 | 400 | 1410 | 1465 | 1880 | 585 | 2198 | 1753 |
| **USC400DSQ-12 to USC500DSQ-12** | mm | 5740 | 475 | 400 | 1410 | 1465 | 1880 | 585 | 2213 | 1723 |
| **USC575DSQ-16 to USC650DSQ-16** | mm | 7440 | 525 | 400 | 2000 | 1645 | 2810 | 585 | 2522 | 1723 |

**Point Loadings & Total Weights**

| | | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | Machine | Operational |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **USC250DSQ-8** | kg | 680 | 540 | (1) | 340 | 680 | 540 | (1) | 340 | 3120 | 3208 |
| **USC275DSQ-8** | kg | 690 | 550 | (1) | 340 | 680 | 540 | (1) | 340 | 3140 | 3228 |
| **USC300DSQ-8** | kg | 690 | 550 | (1) | 340 | 690 | 550 | (1) | 340 | 3160 | 3248 |
| **USC350DSQ-12** | kg | 655 | 680 | 540 | 255 | 615 | 640 | 510 | 245 | 4140 | 4217 |
| **USC400DSQ-12** | kg | 655 | 680 | 540 | 255 | 655 | 680 | 540 | 255 | 4260 | 4383 |
| **USC450DSQ-12** | kg | 675 | 700 | 540 | 255 | 655 | 680 | 540 | 255 | 4300 | 4416 |
| **USC500DSQ-12** | kg | 675 | 700 | 540 | 255 | 675 | 700 | 540 | 255 | 4340 | 4449 |
| **USC575DSQ-16** | kg | 885 | 915 | 650 | 365 | 780 | 800 | 650 | 365 | 5410 | 5550 |
| **USC650DSQ-16** | kg | 885 | 915 | 650 | 365 | 885 | 915 | 650 | 365 | 5630 | 5770 |

(1) Only 6 fixing and loading points to this model.
(2) For AV mount selection on D and DQ models, use the DSQ data provided.

# Installation Data

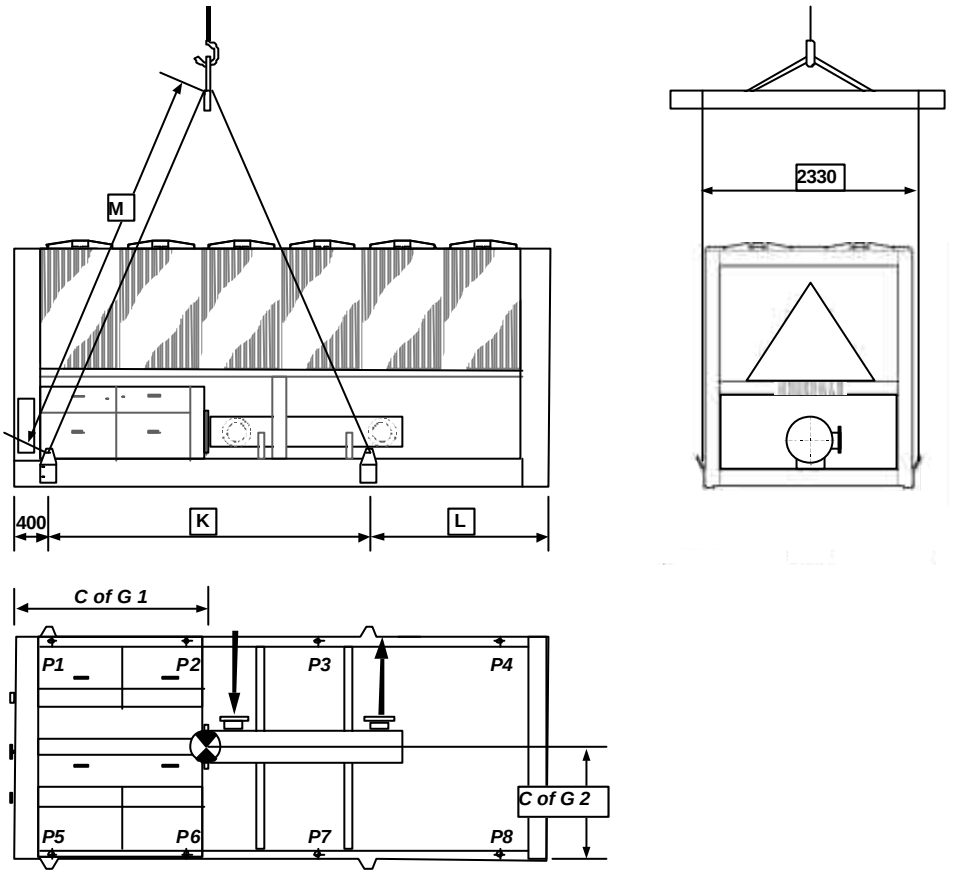
**UNIT LIFTING**

- Employ lifting specialists.
- Local codes and regulations relating to the lifting of this type of equipment should be observed.
- Use the appropriate spreader bars/lifting slings with the holes/lugs provided.
- Attach lifting chains to the 4 lifting lugs provided, each chain must be capable of lifting the whole chiller.
- Lifting hole/lug dimension: 40mm
- Lift the unit slowly and evenly.
- If the unit is dropped, it should immediately be checked for damage and reported to Airedale Service.

**CAUTION** **Only use lifting points provided.**

The unit should be lifted from the base and where possible, with all packing and protection in position. If any other type of slinging is used, due care should be taken to ensure that the slings do not crush the casework or coil.

**LIFTING DIMENSIONS & CENTRE OF GRAVITY**




| | | K | L | M (min) | C of G1 | C of G2 |
|---|---|---|---|---|---|---|
| **USC250D-8 to USC300D-8** | mm | 2465 | 1175 | 3200 | 1460 | 1100 |
| **USC350D-12** | mm | 3420 | 1920 | 3500 | 2150 | 1100 |
| **USC400D-12 to USC500D-12** | mm | 3420 | 1920 | 3500 | 2130 | 1100 |
| **USC575D-16 to USC650D-16** | mm | 5100 | 1940 | 5100 | 2780 | 1100 |

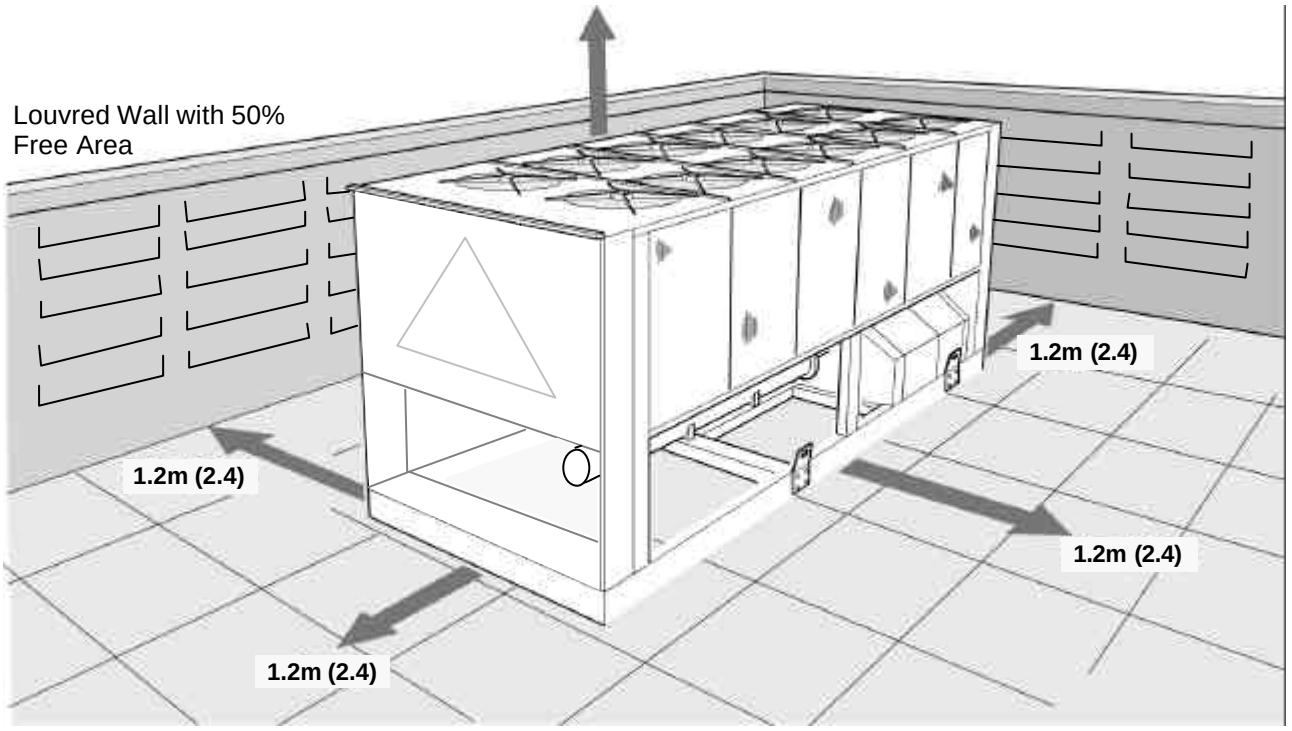
## Installation Data

**POSITIONING**

The installation position should be selected with the following points in mind:

- Position on a stable and even base, levelled to ensure that the compressor operates correctly.
- Levelling should be to +/- 5mm
- Where vibration transmission to the building structure is possible, fit spring anti-vibration mounts and flexible water connections.
- Observe airflow and maintenance clearances.
- Pipework and electrical connections are readily accessible.
- Where multiple units are installed, due care should be taken to avoid the discharge air from each unit adversely affecting other units in the vicinity.
- Within a side enclosed installation, the fan MUST be higher than the enclosing structure.
- Figures in brackets indicate airflow and maintenance clearances for side-enclosed or multiple chiller applications.
- Ensure there are no obstructions directly above the fans.
- Allow free space above the fans to prevent air recirculation.

**CAUTION** **Ensure the unit is completely level and secured prior to connecting services.**



# Installation Data

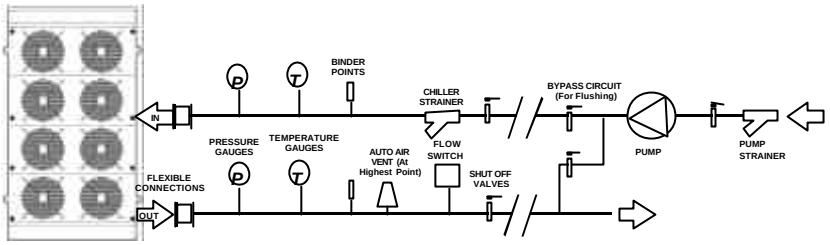
**WATER SYSTEM DATA**

Chilled water pipework and ancillary components must be installed in accordance with:

- National and Local Water supply company standards.
- The manufacturer's instructions are followed when fitting ancillary components.
- The system water is treated to prevent corrosion and algae forming.
- In ambients of 0°C and below and when water supply temperatures of +5°C are required, the necessary concentration of Glycol or use of an electrical trace heater is added where static water can be expected.
- The schematic is referred to as a guide to ancillary recommendations.

**CAUTION** **No liability for externally connected pipework will be regarded by Airedale International Air Conditioning Ltd.**

The water flow commissioning valve set is not shown in the diagram, as the valve can be fitted elsewhere within the Chilled Water circuit.




**Component Recommended Requirements**

The recommended requirements to allow commissioning to be carried out correctly are:

- The inclusion of Binder Point To Allow Temperature and pressure readings
- A flow switch or pressure differential switch fitted adjacent to the water outlet side of the Chiller
- An 80-mesh strainer fitted prior to the evaporator inlet
- A water-flow commissioning valve set fitted to the system
- In multiple chiller installations, 1 commissioning valve set is required per chiller
- Air vents are to be installed at all high points and where air is likely to be trapped at intermediate points.
- Drain points are to be installed at all low points in the system and in particular adjacent to the unit for maintenance to be carried out.
- Isolating valves should be installed adjacent to all major items of equipment for ease of maintenance.
- Balancing valves can be installed if required to aid correct system balancing.
- All chilled water pipework must be insulated and vapour sealed to avoid condensation.
- If several units are installed in parallel adjacent to each other, reverse return should be applied to avoid unnecessary balancing valves.

**Pump Statement**

When installing circulating water pumps or equipment containing them, the following rules should be applied:

- Ensure the system is filled with water then vented and the pump primed with water before running the pump. This is required as the pump bearings and mechanical seal faces are cooled by the pumped liquid.
- To avoid cavitation the NPSH (Net Positive Suction Head) and a safety margin of 0.5m head must be available at the pump inlet during operation.

**Pressure Testing**

When all the pipework has been connected in the system, proceed as follows:

- Ensure all shut off and control valves are fully open.
- Pressurise system to the operating pressure, hold for 1 hour (a gradual fall in pressure shown on the gauge indicates a leak).
- Leaks should be found and repaired and the unit pressure tested for a further hour.

When the pressure remains at the operating pressure for 1 hour, the system can be considered leak free.

**CAUTION** **Although a pressure of 1.5 x working pressure is adequate for testing purposes, most local water authorities require 2 x working pressure.**

# Installation Data

### WATER SYSTEM DATA

#### Filling

**CAUTION** **It is recommended that the system be flushed prior to filling to remove debris left in the water pipework between the strainer and cooler to avoid serious damage to the tubes in the cooler.**

During filling the system should be vented at all high points.

Once the system has been completely vented all vents should be closed.

To prevent air locking in the system it is advisable to fill the systems from the lowest point, ie drain point on pipework.

If auto air vents are used then we strongly recommend an auto pressurisation unit be fitted to the system.

| Model | | | USC250…-8 | USC275…-8 | USC300…-8 | USC350…-12 | USC400…-12 |
|---|---|---|---|---|---|---|---|
| **Connections** | | | | | | | |
| Water Inlet / Outlet - Evap | (2) | in | DN 150 | DN 150 | DN 150 | DN 150 | DN200 |
| Water Drain/Bleed - Evap | | in | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 |
| **Water System** | | | | | | | |
| Min. System Water Volume | (3) | L | 1782 | 1960 | 2138 | 2608 | 3014 |
| Max. System Test Pressure | | Bar | 10 | 10 | 10 | 10 | 10 |

| Model | | | USC450…-12 | USC500…-12 | USC575…-16 | USC650…-16 |
|---|---|---|---|---|---|---|
| **Connections** | | | | | | |
| Water Inlet / Outlet - Evap | (2) | in | DN200 | DN200 | DN200 | DN200 |
| Water Drain/Bleed - Evap | | in | 1/2 | 1/2 | 1/2 | 1/2 |
| **Water System** | | | | | | |
| Min. System Water Volume | (3) | L | 3294 | 3624 | 4253 | 4564 |
| Max. System Test Pressure | | Bar | 10 | 10 | 10 | 10 |

(2) Flanged to PN16.
(3) For minimum system volume calculations, refer to the ***Technical Manual***.

### GLYCOL DATA

Glycol is recommended when a supply water temperature of +5°C or below is required or when static water can be exposed to freezing temperatures.

#### Ethylene Glycol Nominal Correction Factors

| Glycol in System / Freezing Point ºC | | 10% / -4°C | 20% / -9°C | 30% / -15°C | 40% / -23°C |
|---|---|---|---|---|---|
| Cooling Duty | Multiply by | 0.98 | 0.97 | 0.95 | 0.93 |
| Input Power | | 0.99 | 0.98 | 0.96 | 0.95 |
| Water Flow | | 0.99 | 0.99 | 0.99 | 1.00 |
| Pressure Drop | | 0.99 | 0.99 | 0.99 | 1.00 |

#### Propylene Glycol Nominal Correction Factors

| Glycol in System / Freezing Point ºC | | 10% / -2°C | 20% / -6°C | 30% / -12°C | 40% / -20°C |
|---|---|---|---|---|---|
| Cooling Duty | Multiply by | 0.97 | 0.95 | 0.91 | 0.88 |
| Input Power | | 0.99 | 0.98 | 0.96 | 0.95 |
| Water Flow | | 0.98 | 0.97 | 0.95 | 0.95 |
| Pressure Drop | | 0.99 | 0.99 | 0.98 | 0.98 |

# Installation Data

## ELECTRICAL DATA

**General**

- As standard the equipment is designed for 400V, 3 phase, 3 wire 50Hz and a permanent 230V, 1 phase, 50Hz supply, to all relevant IEE regulations, British standards and IEC requirements.

**CAUTION**

- **Ensure correct phase rotation.**
- A fused and isolated electrical supply of the appropriate phase, frequency and voltage should be installed.
- The control voltage to the interlocks is 24V. Always size the low voltage interlock and protection cabling for a maximum voltage drop of 2V.

**CAUTION**

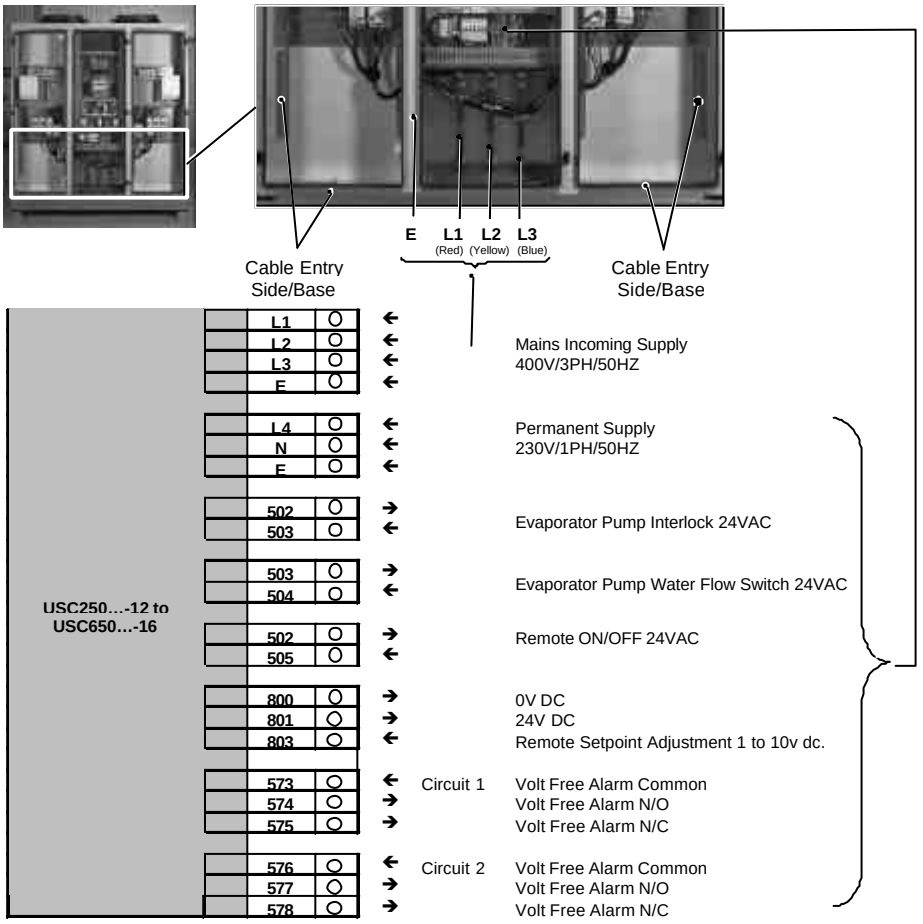
- **Wires should be capable of carrying the maximum load current under non-fault conditions at the stipulated voltage.**
- Avoid large voltage drops on cable runs, particularly low voltage wiring.
- Once the connecting pipework is complete the electrical supply can be connected by routing the cable through the appropriate casing hole and connecting the cables, refer to the ***Wiring Diagram*** supplied with each unit.

**CAUTION** **A separately fused, locally isolated, permanent single phase and neutral supply is required for the compressor sump heater, evaporator trace heating and control circuits.**

**Interlocks & Protection** Always electrically interlock the operation of the chiller with the pump interlocks ***and*** water flow switch for safety reasons. ***Failure to do this will invalidate the chiller warranty.***

**CAUTION** **Do not rely solely on the BMS to protect the chiller against low flow conditions. An evaporator interlock and flow switch MUST be fitted.**

**Interconnecting Wiring** For full control panel component layout, refer to ***Parts Identification***.



# Installation Data

**ELECTRICAL DATA**

| Model | | | USC250...-8 | USC275...-8 | USC300...-8 |
|---|---|---|---|---|---|
| **Unit Data** | (1) | | | | |
| Nominal Run Amps | (2) | A | 164 | 176 | 188 |
| Maximum Start Amps | | A | 275 | 287 | 344 |
| Permanent Supply | | VAC | | 230 V 1 PH 50 Hz | |
| Mains Supply | | VAC | | 400 V 3 PH 50 Hz | |
| Recommended Permanent Fuse Size | | A | 16 | 16 | 16 |
| Recommended Mains Fuse Size | | A | 200 | 250 | 250 |
| Maximum Permanent Incoming Cable Size | | mm² | | 4mm² Terminal | |
| Maximum Mains Incoming Cable Size | | mm² | | Direct to Bus Bar | |
| Control Circuit | | VAC | | 24V / 230VAC | |
| **Evaporator** | | | | | |
| Trace Heater Rating | | W | 175 | 200 | 200 |
| **Condenser Fan - Per Fan** | | | | | |
| Full Load Amps | | A | 1.75 | 1.75 | 1.75 |
| Locked Rotor Amps | | A | 6.20 | 6.20 | 6.20 |
| Motor Rating | | kW | 0.98 | 0.98 | 0.98 |
| **Compressor - Per Compressor** | | | | | |
| Motor Rating | | kW | 43 | 50 + 43 | 50 |
| Nominal Run Amps | (2) | A | 75 | 87 + 75 | 87 |
| Crankcase Heater Rating | | kW | 150 | 150 | 150 |
| Start Amps | (3) | | 193 | 250 + 193 | 250 |
| Type Of Start | | | | Star / Delta | |
| **OPTIONAL EXTRAS** | | | | | |
| **Power Factor Correction** | | | | | |
| Nominal Run Amps | (2) | A | 150 | 160 | 170 |
| Maximum Start Amps | (3) | A | 275 | 287 | 344 |
| Recommended Mains Fuse | | A | 200 | 200 | 250 |
| Compressor Nominal Run Amps - Per Compressor | | A | 68 | 78 + 68 | 78 |
| **Closed Transition Start** | | | | | |
| Nominal Run Amps | (2) | A | 164 | 176 | 188 |
| Maximum Start Amps | | A | 275 | 287 | 344 |
| Recommended Mains Fuse | | A | 200 | 250 | 250 |
| Compressor Nominal Run Amps - Per Compressor | | A | 75 | 87 + 75 | 87 |
| **SUPER QUIET DSQ** | | | All data as above except: | | |
| **Condenser Fan - Per Fan** | | | | | |
| Full Load Amps | | A | 1.15 | 1.15 | 1.15 |
| Locked Rotor Amps | | A | 2.10 | 2.10 | 2.10 |
| Motor Rating | | kW | 0.70 | 0.70 | 0.70 |

(1) Refers to standard speed fans.
(2) Based at 12/7°C water and 30°C ambient
(3) Starting amps refers to the Star connection only.

# Installation Data

### ELECTRICAL DATA

| Model | | | USC350...-12 | USC400...-12 | USC450...-12 |
|---|---|---|---|---|---|
| **Unit Data** | (1) | | | | |
| Nominal Run Amps | (2) | A | 222 | 249 | 279 |
| Maximum Start Amps | | A | 375 | 373 | 403 |
| Permanent Supply | | VAC | | 230 V 1 PH 50 Hz | |
| Mains Supply | | VAC | | 400 V 3 PH 50 Hz | |
| Recommended Permanent Fuse Size | | A | 16 | 16 | 16 |
| Recommended Mains Fuse Size | | A | 315 | 315 | 355 |
| Maximum Permanent Incoming Cable Size | | mm² | | 4mm² Terminal | |
| Maximum Mains Incoming Cable Size | | mm² | | Direct to Bus Bar | |
| Control Circuit | | VAC | | 24V / 230VAC | |
| **Evaporator** | | | | | |
| Trace Heater Rating | | W | 200 | 200 | 200 |
| **Condenser Fan - Per Fan** | | | | | |
| Full Load Amps | | A | 1.75 | 1.75 | 1.75 |
| Locked Rotor Amps | | A | 6.20 | 6.20 | 6.20 |
| Motor Rating | | kW | 0.98 | 0.98 | 0.98 |
| **Compressor - Per Compressor** | | | | | |
| Motor Rating | | kW | 68 + 50 | 68 | 87 + 68 |
| Nominal Run Amps | (2) | A | 114 + 87 | 114 | 144 + 114 |
| Crankcase Heater Rating | | kW | 150 | 150 | 150 |
| Start Amps | (3) | | 248 + 250 | 248 | 316 + 248 |
| Type Of Start | | | | Star / Delta | |
| **OPTIONAL EXTRAS** | | | | | |
| **Power Factor Correction** | | | | | |
| Nominal Run Amps | (2) | A | 201 | 225 | 252 |
| Maximum Start Amps | (3) | A | 375 | 373 | 403 |
| Recommended Mains Fuse | | A | 250 | 315 | 315 |
| Compressor Nominal Run Amps - Per Compressor | | A | 102 + 78 | 102 | 129 + 102 |
| **Closed Transition Start** | | | | | |
| Nominal Run Amps | (2) | A | 222 | 249 | 279 |
| Maximum Start Amps | | A | 375 | 373 | 403 |
| Recommended Mains Fuse | | A | 315 | 315 | 355 |
| Compressor Nominal Run Amps - Per Compressor | | A | 114 + 87 | 114 | 144 + 114 |
| **SUPER QUIET DSQ** | | | All data as above except: | | |
| **Condenser Fan - Per Fan** | | | | | |
| Full Load Amps | | A | 1.15 | 1.15 | 1.15 |
| Locked Rotor Amps | | A | 2.10 | 2.10 | 2.10 |
| Motor Rating | | kW | 0.70 | 0.70 | 0.70 |

(1) Refers to standard speed fans.
(2) Based at 12/7°C water and 30°C ambient
(3) Starting amps refers to the Star connection only.

# Installation Data

**ELECTRICAL DATA**

| Model | | | USC500...-12 | USC575...-16 | USC650...-16 |
|---|---|---|---|---|---|
| **Unit Data** | (1) | | | | |
| Nominal Run Amps | (2) | A | 309 | 353 | 390 |
| Maximum Start Amps | | A | 471 | 511 | 484 |
| Permanent Supply | | VAC | | 230 V 1 PH 50 Hz | |
| Mains Supply | | VAC | | 400 V 3 PH 50 Hz | |
| Recommended Permanent Fuse Size | | A | 16 | 16 | 16 |
| Recommended Mains Fuse Size | | A | 400 | 450 | 500 |
| Maximum Permanent Incoming Cable Size | | mm² | | 4mm² Terminal | |
| Maximum Mains Incoming Cable Size | | mm² | | Direct to Bus Bar | |
| Control Circuit | | VAC | | 24V / 230VAC | |
| **Evaporator** | | | | | |
| Trace Heater Rating | | W | 250 | 250 | 250 |
| **Condenser Fan - Per Fan** | | | | | |
| Full Load Amps | | A | 1.75 | 1.75 | 1.75 |
| Locked Rotor Amps | | A | 6.20 | 6.20 | 6.20 |
| Motor Rating | | kW | 0.98 | 0.98 | 0.98 |
| **Compressor - Per Compressor** | | | | | |
| Motor Rating | | kW | 87 | 107 + 87 | 107 |
| Nominal Run Amps | (2) | A | 144 | 181 + 144 | 181 |
| Crankcase Heater Rating | | kW | 150 | 150 | 150 |
| Start Amps | (3) | | 316 | 289 + 316 | 289 |
| Type Of Start | | | | Star / Delta | |
| **OPTIONAL EXTRAS** | | | | | |
| **Power Factor Correction** | | | | | |
| Nominal Run Amps | (2) | A | 279 | 319 | 352 |
| Maximum Start Amps | (3) | A | 471 | 511 | 484 |
| Recommended Mains Fuse | | A | 355 | 400 | 450 |
| Compressor Nominal Run Amps - Per Compressor | | A | 129 | 162 + 129 | 162 |
| **Closed Transition Start** | | | | | |
| Nominal Run Amps | (2) | A | 309 | 353 | 390 |
| Maximum Start Amps | | A | 471 | 511 | 484 |
| Recommended Mains Fuse | | A | 400 | 450 | 500 |
| Compressor Nominal Run Amps - Per Compressor | | A | 144 | 181 + 144 | 181 |
| **SUPER QUIET DSQ** | | | All data as above except: | | |
| **Condenser Fan - Per Fan** | | | | | |
| Full Load Amps | | A | 1.15 | 1.15 | 1.15 |
| Locked Rotor Amps | | A | 2.10 | 2.10 | 2.10 |
| Motor Rating | | kW | 0.70 | 0.70 | 0.70 |

(1) Refers to standard speed fans.
(2) Based at 12/7°C water and 30°C ambient
(3) Starting amps refers to the Star connection only.

# Controls

## CONTROL SCHEME FEATURES

### General

Airedale recognises that all chiller applications are different but fall mainly into 2 application categories; Variable Supply Temperature and Constant Supply Temperature.

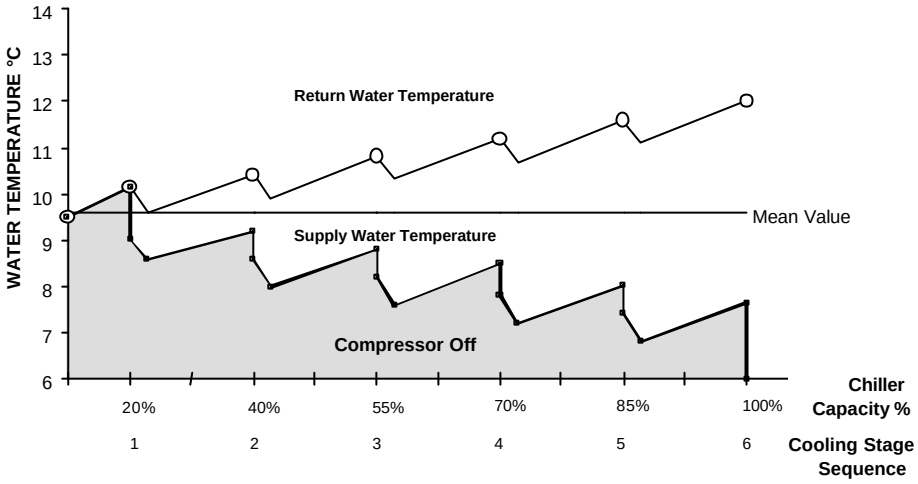
The onboard microprocessor has the capability of satisfying either control requirement as illustrated below. Using the Airedale Variable Supply Temperature control scheme, energy savings are available when compared with previous schemes and that of the Constant Supply Temperature application.

Variable Supply Temperature control schemes offer energy savings where the supply water temperature is not critical to its operation.

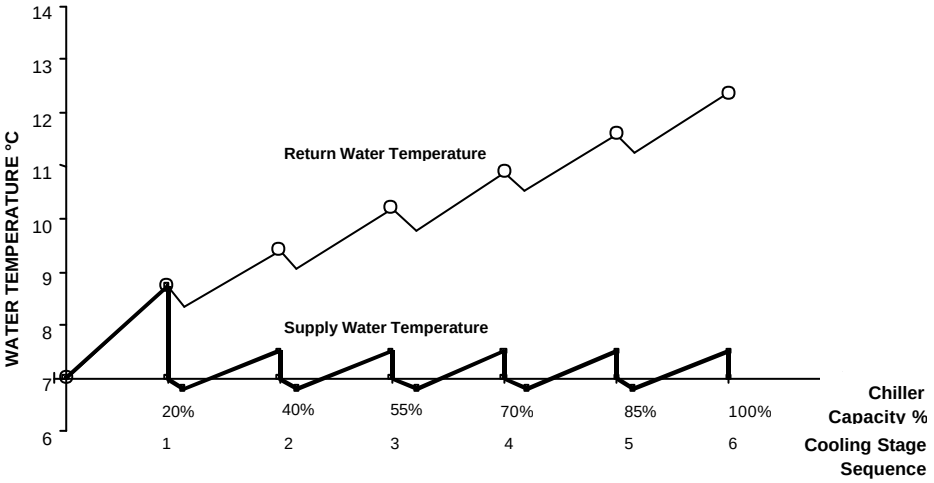
Selection of the best application control scheme can be made via a software switch in the microprocessor during initial commissioning.

**Examples based on Models USC250...-8 to USC500…-12 having 6 Stages of Cooling**

### Variable Supply Temperature Control




### Constant Supply Temperature Control

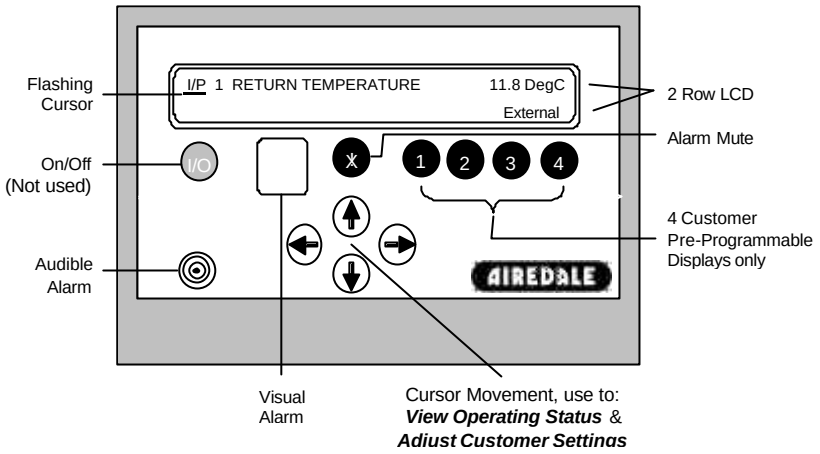



**CAUTION** **Prior to enabling the unit, the mode of operation should be selected, refer to *Adjusting Customer Control Settings - Constant Supply Control*.**

# Controls

## OPERATION

### Display Keypad




### Access, Navigation & Adjustment

The display is used for **Viewing Unit Operating Status** and **Adjusting Customer Control Settings** by allowing the operator access to a series of **Display Pages**. Viewing information is unrestricted, however set up and adjustment requires password entry, refer to ***Password Protection***.

Use the cursor to direct you through the **Display Pages,** use the ▶ / ◀ keys to place the cursor to the top left of the display and use ▲ / ▼ keys to scroll through available pages.

When the desired page is selected, to **Adjust Customer Control Settings**, place the cursor under the item to change using the ▶ / ◀ keys and then increase/decrease the value by using the ▲ / ▼ keys.

### Password Protection

To guard against unauthorised adjustments, a password is required to gain access.

**FACTORY SET PASSWORD PIN NUMBER: 4648** (or Customer chosen number).

Once protected, using a **Software Knob** for example, use the following instructions to make a change:

1 Select the desired **Software Knob** display.
2 Attempt to change the **Software Knob** value which will result in the display "**5*** Enter your PIN**"
3 To enter the **PIN** number, place the cursor under each of the 4 digits represented as "**5***" and select the desired numbers using the ▲ / ▼ keys.
4 Following entry of the last digit there will be a short delay, then access will be made available.

The display will automatically **Time Out** after **2 minutes** following the last keystroke /cursor movement to prevent unauthorised access.

**CAUTION** **The display "EDIT INHIBITED" will appear if the PIN entered is invalid or excessive time is taken to enter the PIN. Check and re-enter the PIN number to clear.**

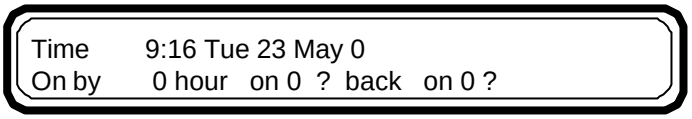
### Display Pages (Listed in Sequence)

| PAGE TITLE | SCREEN DISPLAYS |
|---|---|
| Status Page | **"Status"** |
| Real Time Clock | **"Time"** |
| Sensor Inputs | **"Sens"** |
| Digital Sensors | **"Digin"** |
| Software Knobs | **"Knob"** |
| Software Switches | **"Switch"** |
| Drivers | **"Driver"** |
| Time Zones | **"Zone"** |
| Optimum Start/Stop | **"Oss" - NOT USED** |
| Calendar | **"Calendr"** |
| Alarms | **"Alarm"** |
| Auto Dial Option | **"DIALLER" - NOT USED** |

# Controls

**SETTING UP** Always start from the **Status** page.

**Real Time Clock**




To set , move the cursor under the number or month you wish to change and increase or decrease by using the ▲ / ▼ keys as required.

**CAUTION** **Line 2, refers to seasonal time changes which must only be programmed on <u>one</u> unit within a network.**

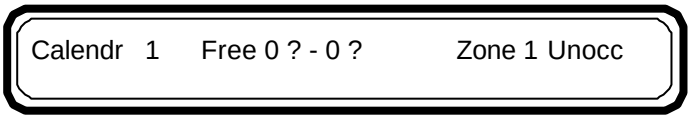
**Time Zones**

The programme provides 3 factory set periods, which provide 24 hour per day continuous operation and can be altered to suit. The unit will be factory set for continuous operation and will not normally require further adjustment.

**Set up**

1. Position the cursor under the time value(s) to change and increase or decrease by using the ▲ / ▼ keys as required.
2. Move the cursor to the period type eg "**Next"** and select as follows:
   "**Every"** - will operate during the programme times every week.
   **"Next"** - will operate on the next occurrence of the times set and then revert to "**Every"**.

**Calendar**




The **Calendar** offers 20 holiday dates, programmable as individual days or periods of up to 99 days. The unit will be factory set for no holiday shut down and will not normally require further adjustment.

**CAUTION** **Holidays must be programmed at least 7 days before the actual holiday date.**

**Set up**

1. Position cursor under the calendar number eg **Calendr <u>1,</u>** to select the first set-up period.
2. Move the cursor to period type eg "**Free"** and select as follows:
   "**Free"** - holiday will not occur
   "**Next"** - holiday displayed will activate at next occurrence only and then "**Free"**after
   "**Every"** - holiday will occur every year.
3. Move to the start day eg **"0"**, scroll through 1-31 days as required.
4. Move to the start month eg **"?",** select month.
5. Repeat 3 & 4 for the end date.
6. **"Zone"** and **"Unocc"** are not used.
7. Repeat the above for each period.

**Pre-Programmable Keys** The keys numbered **1, 2, 3** and **4** can provide quick access to 4 customer pre-programmed items such as frequently monitored or changed displays.

**Set up**

1. Select the required display and position the cursor under the value or setting number.
2. Press **Key 1** and hold down. Initially the display will revert to the previously programmed page. After 5 seconds the display will revert to the new selection.
3. Repeat steps 1 and 2 for **Keys 2, 3** and **4**.

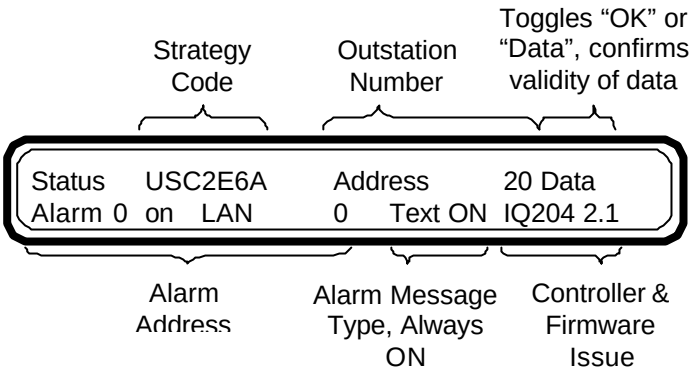
**Technical Support** A full Controls Manual is available on request, please contact **Airedale Services**.

# Controls

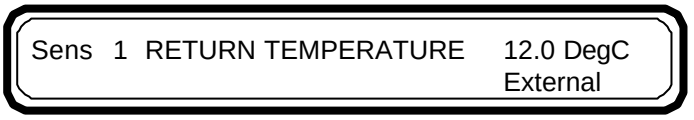
### VIEWING UNIT OPERATING STATUS

**Status Page**

The **Status** page will appear following start up of the controller; it is recommended that the display is always returned to the **Status** page following review or adjustment.




**Sensor Inputs**




To view, position the cursor under the sensor number eg "**Sens 1**", scroll through the sensors as listed:

| | | |
|---|---|---|
| **Sens 1** | RETURN TEMPERATURE | Hard Wired Input Sensors |
| **Sens 2** | SUPPLY TEMPERATURE | |
| **Sens 3** | CP1 SUCTION PRESSURE | |
| **Sens 4** | CP1 LIQUID PRESSURE | |
| **Sens 6** | CP2 SUCTION PRESSURE | |
| **Sens 7** | CP2 LIQUID PRESSURE | |
| **Sens 8** | REM. SETPOINT INPUT | |
| **Sens 9** | REMOTE SETPOINT | Internally Calculated Sensor Values |
| **Sens 10** | COMP. 1 HOURS RUN | |
| **Sens 11** | COMP. 2 HOURS RUN | |

**Digital Inputs**

To view, position the cursor under the digital input number eg "**Digin 1**", scroll through the sensors as listed:

| | | |
|---|---|---|
| **Digin 1** | PHASE ROTATION | Hard Wired Input Sensors |
| **Digin 2** | EMERGENCY STOP | |
| **Digin 3** | EVAP. FLOW SWITCH | |
| **Digin 4** | REMOTE ON/OFF | |
| **Digin 5** | COMPRESSOR 1 STATUS | |
| **Digin 6** | NOT USED | |
| **Digin 7** | COMPRESSOR 2 STATUS | |
| **Digin 8** | EEV ALARM INPUT | |
| **Digin 9** | EVAP. FLOW FAILURE | Internally Calculated Sensor Values |
| **Digin 10** | LOW SUPPLY TEMP. | |
| **Digin 11** | CCT 1 FAULT | |
| **Digin 12** | CCT 2 FAULT | |
| **Digin 13** | CCT 1 LOW SUCTION | |
| **Digin 14** | CCT 2 LOW SUCTION | |
| **Digin 15** | CCT 1 HIGH LIQUID | |
| **Digin 16** | CCT 2 HIGH LIQUID | |
| **Digin 17** | REMOTE SP FAILURE | |
| **Digin 18** | EEV CONTROL FAILURE | |

# Controls

### VIEWING UNIT OPERATING STATUS

**Driver Outputs**

Displays the status of the outputs from the controller and will show **"ON/OFF"** or a percentage output as listed:

| | | | |
|---|---|---|---|
| **Driver 1** | CCT 1 COMPRESSOR | 0 – 100 % | |
| **Driver 2** | CCT 2 COMPRESSOR | 0 – 100 % | |
| **Driver 3** | CCT 1 COMMON ALARM | ON / OFF | |
| **Driver 4** | CCT 2 COMMON ALARM | ON / OFF | |
| **Driver 5** | CCT 1 FAN HPC O/P 1 | 0 – 100 % | |
| **Driver 6** | CCT 1 FAN HPC O/P 2 | 0 – 100 % | ***USC 575 & 650 Only*** |
| **Driver 7** | CCT 2 FAN HPC O/P 1 | 0 – 100 % | |
| **Driver 8** | CCT 2 FAN HPC O/P 2 | 0 – 100 % | ***USC 575 & 650 Only*** |

**Alarms**

An **Audio-Visual** alarm will be triggered at the display by the conditions listed below and the controller will effect the following actions.

### COMMON ALARMS

**Phase Rotation**

A normally closed contact. When Phase Rotation is incorrect all controller outputs are de-activated.

**Emergency Stop**

A normally open contact. On closing, all controller outputs are de-activated.

**Evaporator Flow Failure**

A normally closed contact. On opening, all controller outputs are de-activated.

**Low Supply Temperature**

Supply Water Temperature Low Limit alarm is generated when the supply water temperature falls below the low limit value set. All controller outputs are de-activated.

**Remote Setpoint Failure**

If the Remote Setpoint input becomes open or short-circuited while the remote setpoint is enabled, the unit will revert to the internal Supply Water Temperature setpoint.

**Electronic Expansion Valve Control Failure**

This indicates that the Electronic Expansion Valve (EEV) controller has detected an operating problem with either one or both circuits.

**Restart**

When power is restored. A restart alarm message will be recorded in the alarm log

### INDIVIDUAL CIRCUIT ALARMS

**Circuit 1 / 2 Fault**

A normally closed contact when the compressor is operating. If this contact remains open for a period of 15 seconds during operation of the compressor, the relevant compressor will be de-activated.

**Circuit 1 / 2 Low Suction Pressure**

When the Suction Pressure Sensor Value falls below the value set by the low suction level for a period exceeding 1 minute (or 3 minutes on compressor start-up), the relevant compressor will be de-activated.

**Circuit 1 / 2 High Liquid Pressure**

When the Liquid Pressure Sensor Value reaches 23BarG, the relevant compressor will unload its final stage and will only reset when its drops below 21BarG.

**Alarm Handling**

The **Alarm** page holds the last 20 alarm messages in descending chronological order. The messages indicate active alarms and cleared alarms following rectification.

- Press the **Mute** button to silence the audible alarm.
- Display the **Alarm** page to identify the nature of the alarm.
- Determine if the alarm is auto-resetting or requires some form of manual reset.
- If the alarm requires manual reset isolate the unit before further investigation (refer to ***Software Switches - Alarm Reset***).

**CAUTION** **ALWAYS press the Mute button following an alarm to de-active automatically.**

# Controls

### ADJUSTING CUSTOMER CONTROL SETTINGS

**Software Knobs**

The following factory set unit operating and alarms settings may be viewed and adjusted:

| Knob Title & Sequence | Factory Set | Range |
|---|---|---|
| • Restart Delay | 10 seconds | 10 - 120 |
| • Supply Water Temperature Setpoint | 7°C | -7 - 20 |
| • Unit Temperature Difference | 5°C | 4 - 8 |
| • Supply Water Temperature Low Limit | 3°C | -10 - 20 |
| • Low Suction Level | 3.2 BarG | 2.5 - 10 |
| • Compressor Loading Delay | 90 seconds | 10 - 120 |
| • Head Pressure Control Setpoint | 17 BarG | 10 - 25 |
| • Head Pressure Control Stage Differential | 18% | 0 - 18 |
| • Head Pressure Control Proportional Gain | -20 | -100 - 0 |
| • Head Pressure Control Integral Term | 5 | 0 - 100 |
| • Unit Loading Stage 1 to 8 | Refer to Airedale | 0 - 100 |

**Restart Delay**

The Restart Delay is the delay before the controller energises any of its controlled outputs after a power failure. In order not to induce large currents on multiple unit systems start-up, the restart delay may be adjusted to different values within each chiller controller.

**Supply Water Temperature Setpoint**

The controller uses the Supply Water Temperature Setpoint and the unit temperature difference setting to calculate the individual cooling stage setpoints, i.e. the temperatures at which each of the compressor stages are activated or de-activated.

The setpoint is utilised for both Constant and Variable Supply Water Temperature controls schemes.

**Unit Temperature Difference**

The Unit Temperature Difference entered should be equal to the temperature difference between supply and return water when the unit is operating at maximum cooling capacity.

**Supply Water Temperature Low Limit**

If the Supply Water Temperature falls below the low limit value set by this knob the controller will generate a manual reset alarm and de-activate all controller outputs.

Due to the application of low temperature glycol systems, it is possible to adjust this temperature below 0°C.

**CAUTION** **Under no circumstances should the low temperature value be adjusted to within less than 3°C of the freezing temperature of the fluid being used.**

**Low Suction Level**

When the suction pressure sensor value falls below the value set by the Low Suction Level for a period exceeding 1 minute or 3 minutes on compressor start-up, an audio-visual alarm will be generated at the display and the relevant compressor will be de-activated.

**Compressor Loading Delay**

If, after a cooling stage has been initialised there is still a cooling demand; the controller will inhibit the next cooling stage output until the duration in this knob setting has elapsed. If the cooling demand is still required after this delay period has elapsed the controller will initialise another cooling stage.

**Head Pressure Control Setpoint**

The head pressure of each circuit will be controlled to the value entered in this knob.

**Head Pressure Control Stage Differential**

When the stepped head pressure control option is selected the value in this knob is used to calculate the actual on and off switching points for each condenser fan stage.

**Head Pressure Control - Gain & Integral Term**

The Gain and Integral Term are used together to calculate the head pressure control output. The proportional gain value must be entered as a negative number.

**Unit Loading Stage 1 - 8**

Factory set to suit the percentage loading of each cooling stage with respect to the unit temperature difference.

# Controls

### ADJUSTING CUSTOMER CONTROL SETTINGS

**Software Switches**

The following factory set application settings may be viewed and adjusted to user requirements:

| Switch Title & Sequence | Factory Set |
|---|---|
| • Local On/Off | Off |
| • Alarm Reset | Off |
| • Constant Supply Water Temperature Control Mode | Off |
| • Stepped or Modulated Head Pressure Control Output | Dependant on unit options fitted |
| • 8 or 12 Condenser Fans Fitted (Only available on 6 stage unit) | |
| • Enable Electronic Expansion Valve Control | |
| • Enable Remote Supply Water Temperature Setpoint | Off |
| • CP1 Hours Run Reset | Off |
| • CP2 Hours Run Reset | Off |
| • CP1 Force Lead / Auto Rotation | Off |
| • CP2 Force Lead / Auto Rotation | Off |

**Local On / Off**

If ON is selected the unit can be operated locally. If OFF is selected then the unit will be operated using the remote on / off customer input.

**Alarm Reset**

If ON, the controller will reset any of the alarm conditions. After a short delay the switch will automatically return to OFF.

**Constant Supply Control**

If ON is selected then the cooling stages will be controlled to maintain **a Constant Supply Water Temperature**. If OFF is selected then the cooling stages will be controlled to provide a **Variable Supply Water Temperature**.

**Head Pressure Control Stepped / Modulated Output**

If ON is selected, the Head Pressure Control Output will produce fixed outputs to operate the condenser fans individually. If OFF is selected, the head pressure control output will modulate between 0 – 100%. When in this mode the output is used to operate the condenser fan speed controllers to vary the fans between minimum and maximum speed.

**Condenser Selection 8 or 12 Fan**

This switch is only used when stepped head pressure control mode is selected. If OFF is selected then 8 fan stepped head pressure control mode is enabled. If ON is selected then 12 fan stepped head pressure control mode is enabled.

**CAUTION** **Only available on 6 stage units with a total of 8 or 12 condenser fans.**

**Enable Remote Setpoint**

If ON is selected then unit will control temperature using the Remote Setpoint customer input. If OFF is selected then the unit will use the supply water temperature setpoint to control the temperature.

**Enable Electronic Expansion Valve Control**

If ON is selected then the controller will monitor the Electronic Expansion Valve Input for an alarm. If OFF is selected then the alarm function is disabled.

**Compressor 1 Hours Run Reset**

Compressor 1 Hours Run can be set to zero by setting this switch to ON. After a short delay the switch will automatically return to OFF.

**Compressor 2 Hours Run Reset**

Compressor 2 Hours Run can be set to zero by setting this switch to ON. After a short delay the switch will automatically return to OFF.

**Compressor 1 Force Lead / Auto**

If ON is selected Compressor 1 will be forced to be the lead compressor regardless of its hours run. If OFF is selected the controller will automatically select the lead compressor based on the lowest hours run.

**Compressor 2 Force Lead / Auto**

If ON is selected Compressor 2 will be forced to be the lead compressor regardless of its hours run. If OFF is selected the controller will automatically select the lead compressor based on the lowest hours run.

**CAUTION** **Either Compressor Force Lead / Auto switch can be ON, but only one can be ON at any one time.**

# Commissioning Data

### GENERAL DATA

#### Operating Limits

| Standard Unit | |
|---|---|
| Minimum Ambient Air DB °C | -5°C |
| Maximum Ambient Air DB °C | Refer to ***Technical Manual*** |
| Minimum Leaving Water Temperature °C | +5°C |
| Maximum Return Water Temperature °C | +20°C |

| Unit with Electronic Fan Speed HP Control (-20°C) | |
|---|---|
| Minimum Ambient Air DB °C | -20°C |
| Maximum Ambient Air DB °C | Refer to ***Technical Manual*** |
| Minimum Leaving Water Temperature °C | +5°C |
| Maximum Return Water Temperature °C | +20°C |

For conditions outside those quoted, please refer to ***Airedale***.

### MECHANICAL DATA

#### Oil & Refrigerant Charges

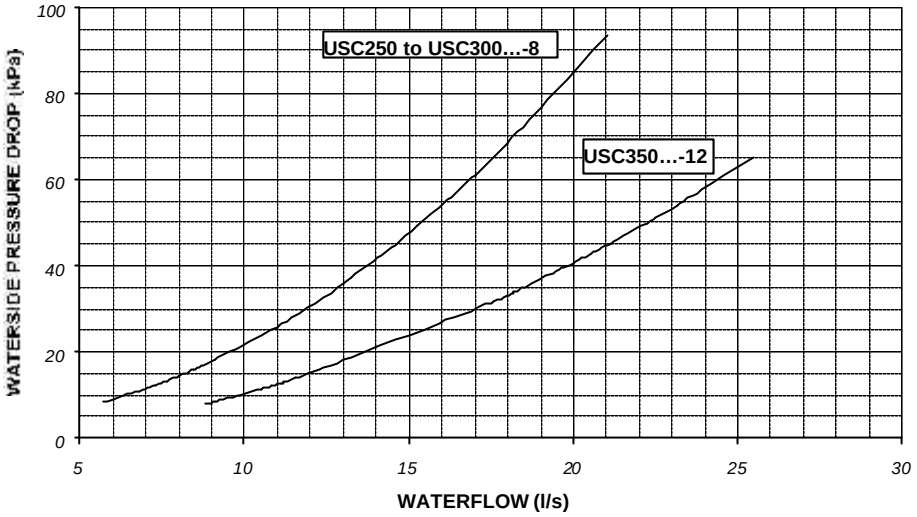
| Model | | USC250…-8 | USC275…-8 | USC300…-8 | USC350…-12 | USC400…-12 |
|---|---|---|---|---|---|---|
| **Compressor** | | | | Screw - Semi Hermetic | | |
| Quantity | | 2 | 2 | 2 | 2 | 2 |
| Oil Charge Volume (Total) | L | 10 + 10 | 10 + 10 | 10 + 10 | 13 + 10 | 13 + 13 |
| Oil Type | | | | Polyolester | | |
| **Refrigeration** | | | | Dual Circuit | | |
| Charge (Total) | kg | 45 + 45 | 55 + 45 | 55 + 55 | 95 + 80 | 95 + 95 |
| **SUPER QUIET DSQ** | | All data as above except: | | | | |
| Refrigerant Charge (Total) | kg | 55 + 55 | 65 + 55 | 65 + 65 | 105 + 90 | 105 + 105 |

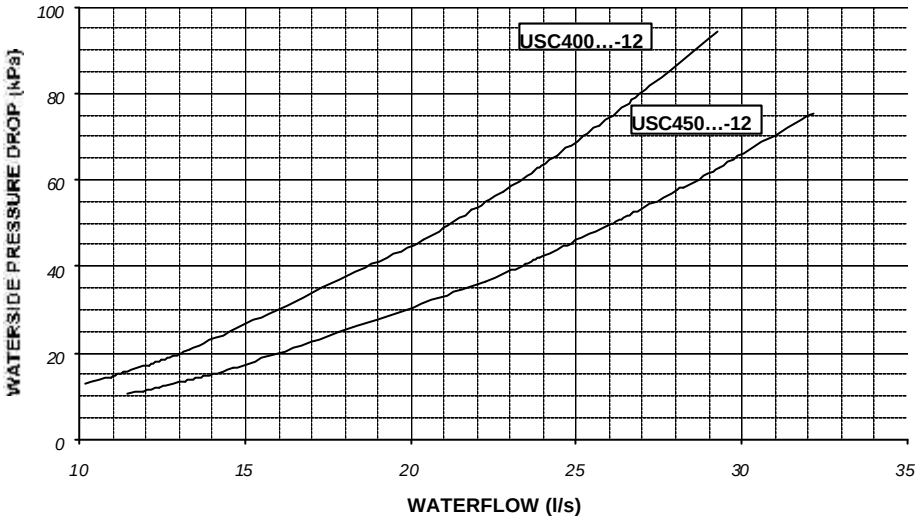
| Model | | USC450…-12 | USC500...-12 | USC575...-16 | USC650...-16 |
|---|---|---|---|---|---|
| **Compressor** | | | Screw - Semi Hermetic | | |
| Quantity | | 2 | 2 | 2 | 2 |
| Oil Charge Volume (Total) | L | 13 + 13 | 13 + 13 | 18 + 13 | 18 + 18 |
| Oil Type | | | Polyolester | | |
| **Refrigeration** | | | Dual Circuit | | |
| Charge (Total) | kg | 95 + 95 | 95 + 95 | 125 + 115 | 125 + 125 |
| **SUPER QUIET DSQ** | | All data as above except: | | | |
| Refrigerant Charge (Total) | kg | 105 + 105 | 110 + 110 | 145 + 145 | 145 + 145 |

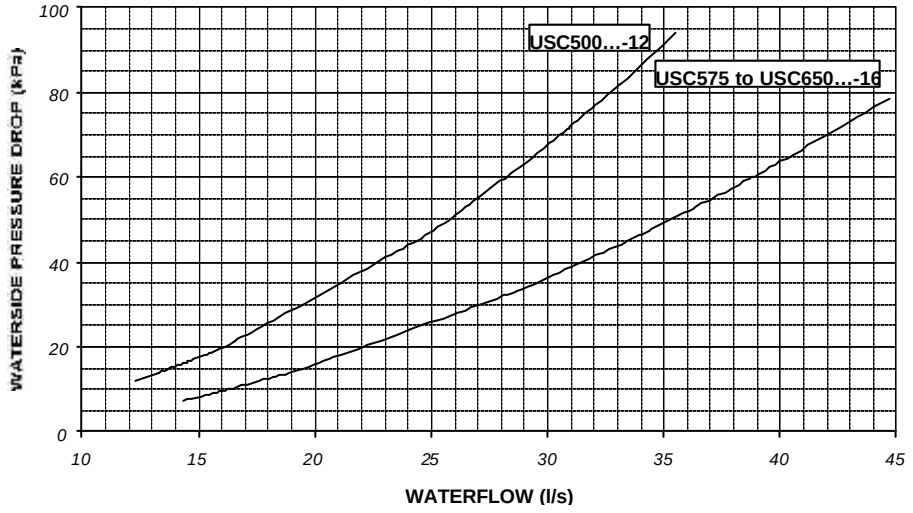
# Commissioning Data

## WATER SYSTEM DATA

### Waterside Pressure Drops



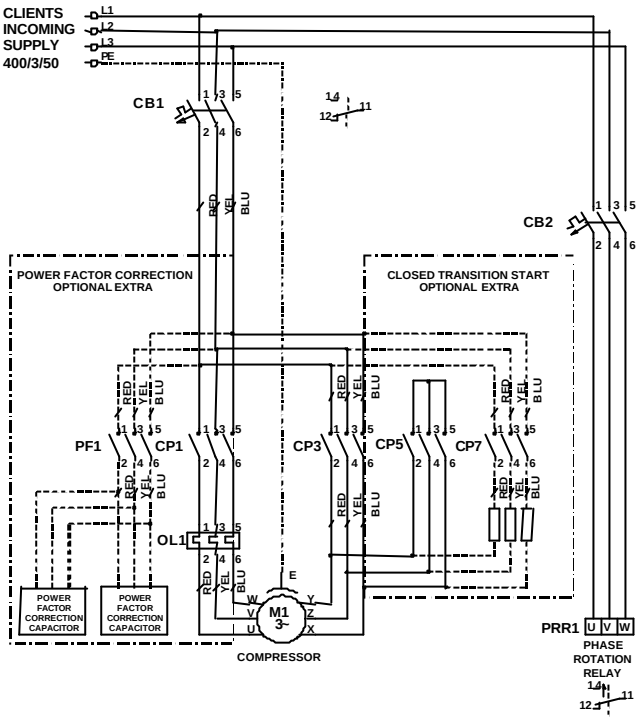



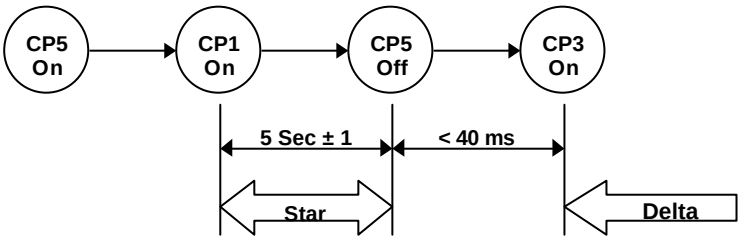
# Commissioning Data

## ELECTRICAL DATA

**compressor Start-Up Information**




**Starting Sequence (Star-Delta Starting)**




**Operational Sequence**

**Refrigerant Charge**

Liquid refrigerant should be charged into the condenser before compressor starting to ensure that refrigerant is present at compressor start-up.

**Crankcase Heater**

The mains supply to the crankcase (oil) heater should be switched on at least 8 hours prior to compressor starting to avoid refrigerant migration.

**Pre-Start-Up Check**

Before compressor start-up, make sure that an oil level is showing in the compressor sight glass, and that all refrigerant ball valves are opened, including the liquid injection line.

**Checks at Compressor Start-up**

As soon as the compressor starts, make sure that the solenoid valve for liquid injection opens, and that the suction and liquid/discharge pressure gauges are showing low and high pressures respectively.

**CAUTION** **If there is no liquid present or no differential pressure occurs, isolate immediately.**

**Check phase rotation by connecting pressure gauges to the suction and discharge ports.**

**Liquid Injection**

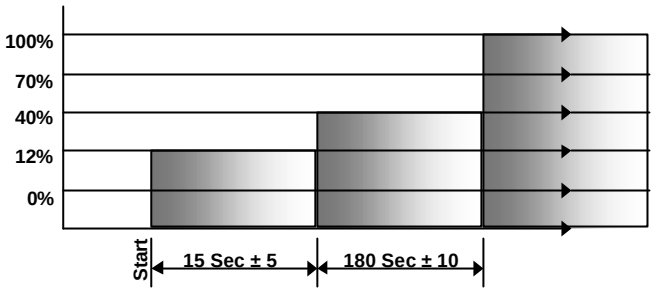
Never shut down the liquid injection circuit whilst the compressor is still running, at any loading condition as this may permanently damage the compressor.

# Commissioning Data

## ELECTRICAL DATA

**Capacity Control**

The following staggered timings are recommended on compressor start-up:




- 12% load (starting position) should be used only at start-up, never as a stage of capacity control.
- 12% load at start-up should be maintained for 10 - 20 seconds to avoid liquid compression.
- The first stage of capacity control (either 25 or 40% depending on compressor size) should be maintained for at least 170 - 190 seconds before further loading.

**Adding Refrigerant**

Additional refrigerant should be added to the system via 1/4" schrader connection on the expansion line.

**Pump Down**

Never shut the liquid injection solenoid valve during or before pump down, and never pump down without the low pressure trip and high discharge temperature switches being operative.

**Unloading Protection**

**Head Pressure**

The microprocessor has inbuilt protection against nuisance trips. If the head pressure rises above 23BarG the compressor will unload to 70% and remain unloaded until the head pressure drops below 21BarG.

**Low Pressure**

If low pressure drops below the microprocessor setting, the compressor will unload to 70%, if low pressure persists for 1 minute, the circuit will be switched off and sound an alarm.

# Commissioning Procedure

**GENERAL**

To be read in conjunction with the commissioning sheets provided, items highlighted should be recorded.

**CAUTION** **Please ensure all documents have been completed correctly and return to Airedale Service immediately to validate warranty.**

**PRE COMMISSIONING CHECKLIST**

**CAUTION** **ALL work MUST be carried out by Technically Trained competent personnel.**

**The equipment contains live electrical and moving parts, ISOLATE prior to maintenance or repair work.**

**Prior to carrying out the following, in order to prevent liquid entering the compressor whilst the mains MCCB are in the OFF position, isolate the liquid injection and liquid line solenoid valves at the terminal blocks (located above the bus bar).**

**The door interlocking MCCB should be in the OFF position and the auxiliary alarm contact from the MCCB should be linked out.**

Ensure all items listed in the Pre commissioning section are complete.

**RECORD**

- The unit should be visually inspected and any damage noted.
- Secure commissioning gauges to the high side of the system, check for a positive charge.
- Check tightness of electrical components.
- Check that the remote on/off switch (if fitted) is in the off position.
- With the MCBs in the off position measure the incoming voltage.
- Check Phase Rotation.
- Check voltage at permanent supply.
- Measure and record the primary (230V) and secondary (24V) voltages at each of the transformers and record on the commissioning document.
- Check all timer settings are correct.
- Check Sump Heater.
- Check oil level.
- Check water filter is fitted.
- Check design water flow is available.
- Check flow switch and pump interlocks are fitted to the water system.
- Switch on the controls and individual circuits, primary and secondary, MCBs to the ON position. At this stage the control display panel should be illuminated.
- Record Optional Extras.
- Record IQ Controller Data.

**CAUTION** **The chiller will not start until microprocessor control SWITCH 1 is in the ON position. DO NOT SWITCH TO ON AT THIS STAGE**

- Adjust the water temperature supply and return set points (if necessary) to call for 100% cooling (refer to the ***Control Section***).
- Ensure all KNOBS and SWITCHES are adjusted to suit the design requirements (refer to the ***Control Section***).
- Turn the unit on by setting SWITCH 1 to enable unit to ON.

**CAUTION** **There will always be a delay between the enabling of the unit and the energising of the compressor contactors, anything between 1 to 2 minutes. Be patient, refer to *Control Section.***

- Check that there is a 5 seconds delay between the Star and Delta contactor energising on each circuit.

**CAUTION** **This delay period would be 0.7 seconds in Closed Transition Starting.**

## Commissioning Procedure

**PRE COMMISSIONING CHECKLIST (CONT..)**

- Check capacity control timing as detailed previously.
- Check that each circuit trips on low pressure. The alarm should appear within 3 minutes.
- The alarm will be recognised at the display circuit trip, clear the alarms as detailed in the microprocessor manual.

**RECORD**

- Reduce the flow rate to 75% of design and ensure that the evaporator pressure differential switch or flow switch trips off this flow rate, adjust if necessary.
- Ensure this alarm is recognised at the display and disengages the circuits operation immediately. Restore flow rate to the design and check the alarm has self-cleared.
- Turn the unit OFF by setting SWITCH 1, enable unit to the OFF position.
- Fully open all liquid line and discharge service ball valves on each circuit.

**CAUTION**

**Re-instate both the liquid injection and liquid line solenoid valves.**

**Remove the link from the MCCB for the auxiliary alarm contact.**

# Commissioning Procedure

**COMMISSIONING CHECKLIST**

The following should be carried out with a load on the system, otherwise the unit is likely to short cycle. The following tests are to be carried out on 1 circuit at a time.

- Switch the door interlocking MCCB to the ON position but again only on the circuit which is to be tested.
- Adjust the water temperature supply and return set points to match the system requirements. Turn the unit ON by setting SWITCH 1, enable unit to the ON position. The unit will start after a short delay.
- Check liquid injection solenoid valve is energised and sight glass is clear.
- Check pressures at suction and discharge ports for correct phase rotation.

**CAUTION** **If there is no liquid present or no differential pressure occurs, isolate immediately.**

**RECORD**

- Check the unloading solenoids operate in the correct sequence - refer to ***Commissioning Data - Electrical Data - Capacity Control***.
- Measure and record the compressor amps once the compressor is fully loaded and at each stage of unloading.
- Measure and record full speed amps of each condenser.
- Ensure that the refrigeration safety cut outs trip at the following settings:

LP micro - adjustable – refer to ***Controls*** section - ***Software Knobs***
LP safety 0.6 +/- 0.1 BarG - fixed
HP safety 24.5 +/- 0.7 BarG - fixed
Clear the alarm as detailed in the microprocessor manual

**CAUTION** **The microprocessor LP setting is adjustable via the micro display. It is recommended that this setting be 0.6 Bar below the equipment freezing point of the cooling medium ie for water (no glycol) LP micro settings is 3.2BarG.**

- Ensure that the low water temperature safety cuts out at the correct setting +/- 0.5°C clear the alarm as detailed in the microprocessor operating manual. For water (no glycol) application the recommended setting is 3°C or 3°C below the design supply water temperature.

**RECORD**

- Check the liquid line sight glass is clear and dry.
- Check the superheat setting adjust the expansion valve to maintain a superheat setting of 5 – 8°C at all operating loads.
- Check and record the following:
  Suction and discharge pressures
  Liquid, discharge and suction line temperature
  Water inlet and outlet temperature
- Ensure the above are all within the design parameters.
- Turn the unit off by setting SWITCH 1, to enable unit.
- Repeat the above for each circuit.
- Turn the unit ON by setting SWITCH 1, enable unit to ON.

The unit is now commissioned and will provide many years of trouble free operation providing the following maintenance schedule is followed.

# Maintenance

**CAUTION** **ALL work MUST be carried out by Technically Trained competent personnel.**

**The equipment contains live electrical and moving parts, ISOLATE prior to maintenance or repair work.**

**GENERAL MAINTENANCE**

The maintenance schedule indicates the time period between maintenance operation.

| 3 MONTHS | ACTION | NOTES |
|---|---|---|
| **REFRIGERATION** | Check the following and compare results with commissioning records.<br>• Suction and discharge readings.<br>• Head pressure control is maintained.<br>• Pressure relief indicator gauge.<br>• Liquid injection solenoid valve and sight glass.<br>• Check each circuit sight glass for dryness and bubbles for indication of leaks.<br>• Check compressor oil level and shell/sump temperature. | Investigate and rectify variations.<br>**Remember to re-cap the Schraeder connections!** |
| **SYSTEM** | Check the following against the commissioning records.<br>• Control settings.<br>• Alarm log for unusual occurrences.<br>• Chilled water control maintains design temperature.<br>• Chilled water flow is within design limits of zero to plus 10%.<br>• Concurrently ensure chilled water pump and flow switch operate efficiently, and that interlocks function correctly.<br>• Operation of waterflow switch and pump interlock. | Investigate and adjust as necessary. |
| **Finally!** | Record operating conditions. | |
| **FABRIC** | Visually inspect the unit for general wear and tear, treat metalwork. | Rust should be inhibited, primed and touched up with matching paint (available from Airedale or your Distributor). |
| | Visually inspect pipe and pipework insulation. | Repair/rectify as necessary. |
| | Clean evaporator water strainer. | At first maintenance visit and then as frequently as necessary (12 months). |
| | Clean condenser coils. **Do not steam clean** use detergent and stiff bristled brush. For heavy dirt, use either a high pressure water or chemical hose. | Do not damage fins and comb out if necessary. |
| | Visually check the following:<br>• Pipework clamps are secure.<br>• Tightness and condition of fan and compressor mounts.<br>• Anti-Vibration mounts fixings (if fitted). | Secure/tighten as necessary. |
| **Finally!** | Ensure control panel lids and access panels have been correctly replaced and securely fastened in position. | |

# Maintenance

**GENERAL MAINTENANCE (CONT..)**

| 6 MONTHS | ACTION | NOTES |
|---|---|---|
| | Repeat 3 month checks plus the following: | |
| **SYSTEM** | Check evaporator trace heating and low ambient thermostat are set to activate at 4.0ºC. | **Remember to re-cap the Schraeder connections!** |
| **12 MONTHS** | **ACTION** | **NOTES** |
| | Repeat 6 month checks plus the following: | |
| **SYSTEM** | Check safety devices cut out the compressor at the correct settings. | |
| **REFRIGERATION** | Check glycol concentration if appropriate. | Adjust as necessary. |
| | Leak test all R407C joints and inspect all water connections. | Rectify as necessary. |
| | Check superheats with chiller running on full load (the height of summer is recommended). Recheck the charge following major adjustment of the superheats. | Adjust as necessary. A period of 30 minutes should be allowed between each resetting of the valve to allow pressures to stabilise. |
| **ELECTRICAL** | Tighten all electrical terminals. | |

**COMPRESSOR MAINTENANCE**

Periodic maintenance and inspection of this equipment is necessary to prevent premature failure, the following periodic inspections should be carried out by period or hourly use which ever is sooner.

| | |
|---|---|
| **1 Year** | Measure compressor motor insulation. |
| **7,500 Hours or 4 Years** | Inspect compressor oil. |
| **20,000 Hours or 4 Years** | Inspect oil filter, gate rotor & suction filter. |

**SHUT DOWN PERIODS**

For periods of winter shut down the following precautions are recommended:

- Close the liquid and discharge ball valve
- Cap service ports
- Turn off electrical circuits
- Drain the water from the chiller evaporator via the evaporator drain plug.

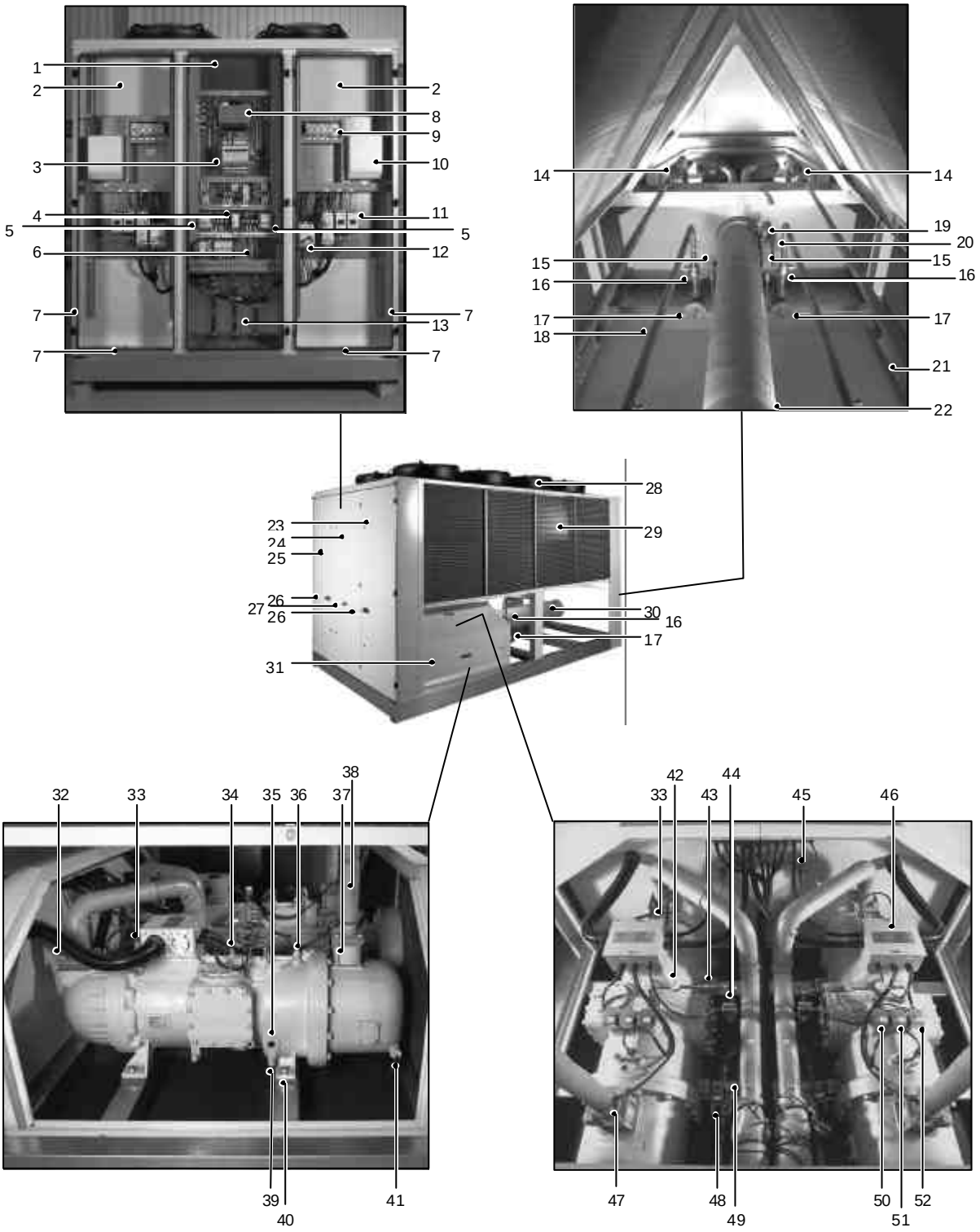
## Parts Identification

**SPARES**

For ease of identification when ordering spares or contacting Airedale about your unit, please quote the unit type, unit serial number and the date of manufacture, which can be found on the unit serial plate.

A spares list for 1, 3 and 5 years will be supplied with every unit and is also available from our Spares department on request.

**The serial plate can be located inside Item 24.**



## Parts Identification

1 Electronic Expansion Valve Controller (Optional Extra)
2 Power Factor Correction/Closed Transition Connection (Optional Extra)
3 Microprocessor Controller (IQ204)
4 Phase Rotation Relay
5 Circuit 1 Timers
6 Incoming Customer Terminals
7 Incoming Customer Mains Access Points
8 Modem
9 Condenser Fan Contactors
10 Modulating Head Pressure Controller
11 Star Delta Contactors
12 Isolator
13 Bus bar Chamber 3 phase Mains Incoming
14 Discharge Line Ball Valve
15 Liquid Injection (Flexible Pipe)
16 Liquid Line Ball Valve
17 Liquid Line Filter Drier
18 Liquid Line
19 Water Inlet Sensor
20 Water Inlet Flange Connection
21 Discharge Line
22 Water Outlet Flange Connection
23 Mains Panel Circuit 2
24 Control Panel (Serial Plate to inside)
25 Mains Panel Circuit 1
26 Door Interlocking isolator
27 Emergency Stop
28 Fan and Motor Assemblies
29 Condenser Coils
30 Evaporator
31 Compressor Housing (DQ and DSQ Models Only)
32 Suction Port
33 Low Pressure Switch
34 Liquid Injection Inlet
35 Oil Level Sight Glass
36 HP Switch
37 Discharge NRV
38 Discharge Shrader Connection
39 Oil Sump Draw Point
40 Compressor Feet/Resilient Pads
41 Sump Heater
42 Liquid Injection Sight Glass
43 Liquid Injection NRV and Strainer
44 Liquid Injection Solenoid Valve
45 Suction Pressure Transducer
46 Compressor Electrical Terminal Box
47 Discharge Thermostat Switch
48 Liquid Line Solenoid Valve
49 Liquid Line Sight Glass
50 70% Unloading Solenoid Valve
51 40% Unloading Solenoid Valve
52 12% Unloading Solenoid Valve

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| | e-mail: | southern.sales@airedale.co.uk |
| **Midlands** | Tel: | 0121 7071010 |
| | e-mail: | midland.sales@airedale.co.uk |
| **Scotland** | Tel: | 0141 2044750 |
| | e-mail: | airesales@email.msn.com |

## International Sales Offices:

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| | e-mail: | mahidineait@aol.com |
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| | e-mail: | info@airedale.de |
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†Manufacturing Facility Also

Part No: 903-099 TM E 05/00